RuggedServer™ RS910

2-Port Serial Device Server with up to 3 Ports Managed Ethernet Switch

Installation Guide

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Should this device require service see the "Warranty" section of this installation guide.

Important

This unit should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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1 Product Overview

1.1 Functional Overview

The RuggedServer™ RS910 is an industrial hardened serial server with an integrated, fully managed, Ethernet switch, designed to operate reliably in electrically harsh and climatically demanding environments. The RS910 can be configured with 2 serial ports (RS485/RS422/RS232/fiber) and/or up to 3 Ethernet ports (copper or fiber). The RS910 is able to interconnect multiple types of intelligent electronic devices (IEDs) that have different methods of communications. Using the RS910 results in fewer connectivity devices and also extends the useful life of existing legacy IEDs.

1.2 Feature Highlights

- Serial Device Server
  - Transmit serial data over an IP network
  - 2 Serial Port Interfaces
  - RS485/RS422/RS232 (DB9 or RJ45 connectors)
  - Serial Fiber Interface (ST) option
  - Support for Modbus TCP, DBP 3, TIN serial protocols
  - Baud rates up to 230 kbps
  - Raw socket mode allows conversion of any serial protocol
  - Point-to-point and multi-point modes
  - Converts Modbus RTU to Modbus; Multiple Modbus masters
  - Converts DNP 3.0 to DNP over UDP/TCP
- Ethernet Ports:
  - Integrated fully Managed Ethernet Switch
  - Up to 3 Fast Ethernet Ports (copper and/or fiber)
  - Supports many types of fiber (Multimode, Singlemode)
  - Multiple connector types (ST, MTRJ, LC, SC)

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1.3 RS910 Front Panel Description

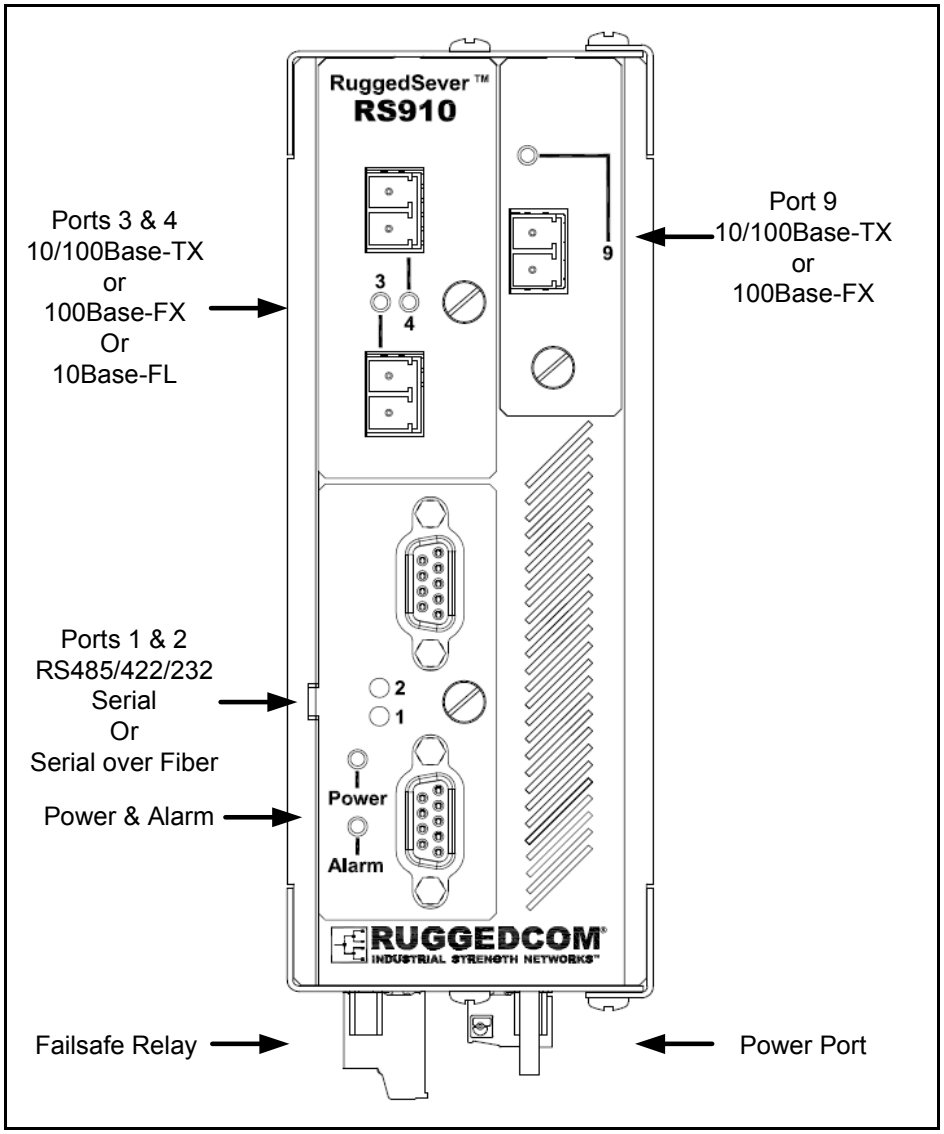

Figure 1 - RS910 Front Panel Description

Status LED	Colour	Activity	Comments
Power LED	Green	Solid	Power On
Alarm LED	Red	Solid	Alarm condition exists

Table 1 - Status LEDs

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1.4 RS910 Bottom Panel Description

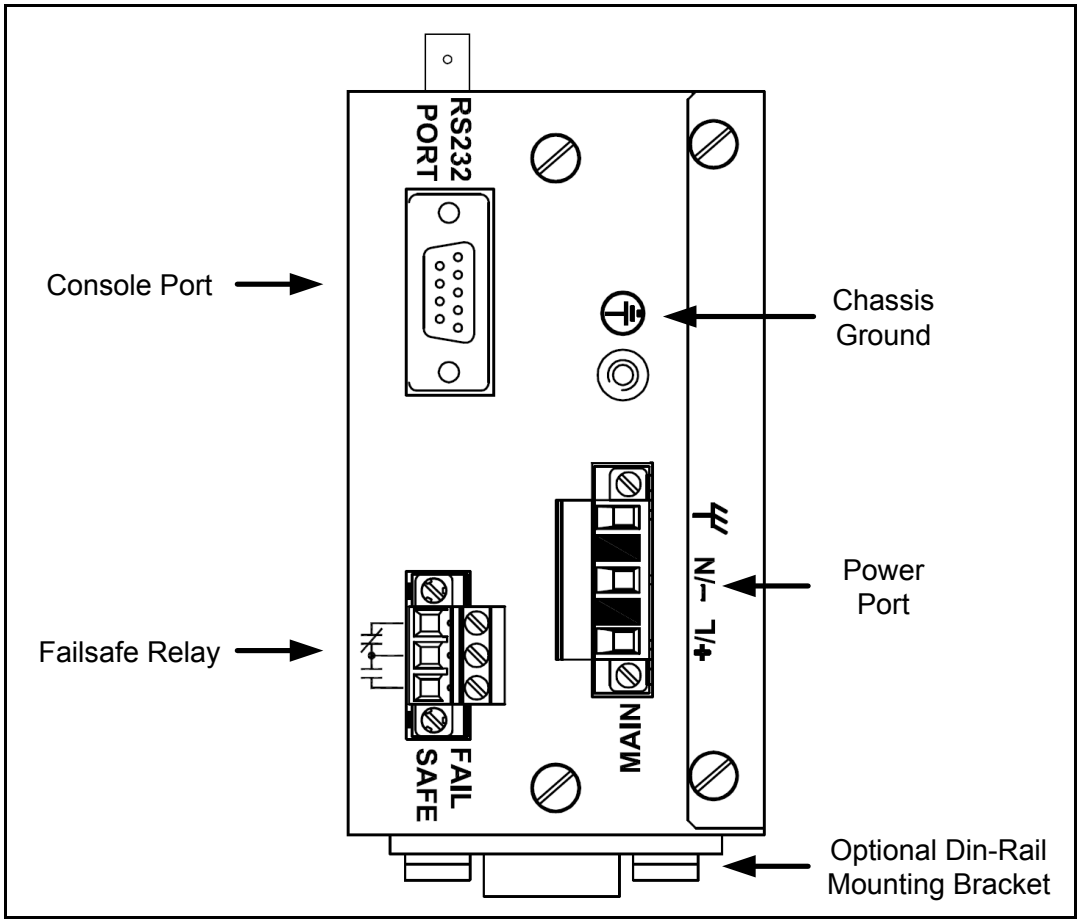

Figure 2 - RS910 Bottom Panel Description

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2 Installation

2.1 Din Rail Mounting

An optional DIN rail mounting bracket is available for the RS910. The figure below details mounting instructions for the standard 1" DIN Rail.

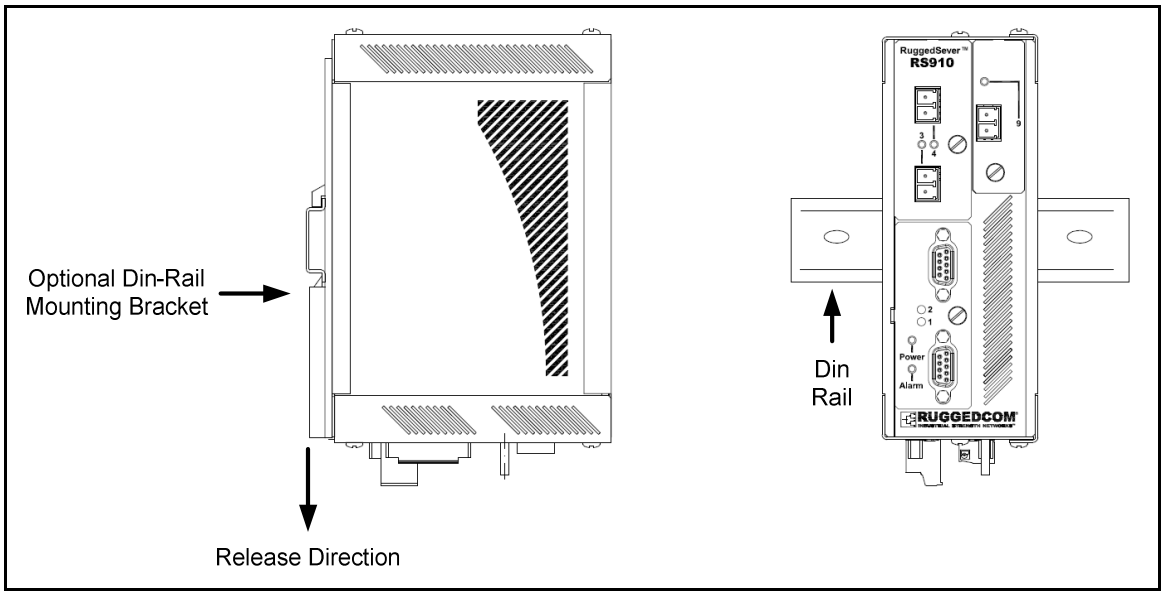

Figure 3 - RS910 DIN Rail Mounting

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2.2 Power Supply Wiring and Grounding

2.2.1 AC Power Supply Wiring and Grounding

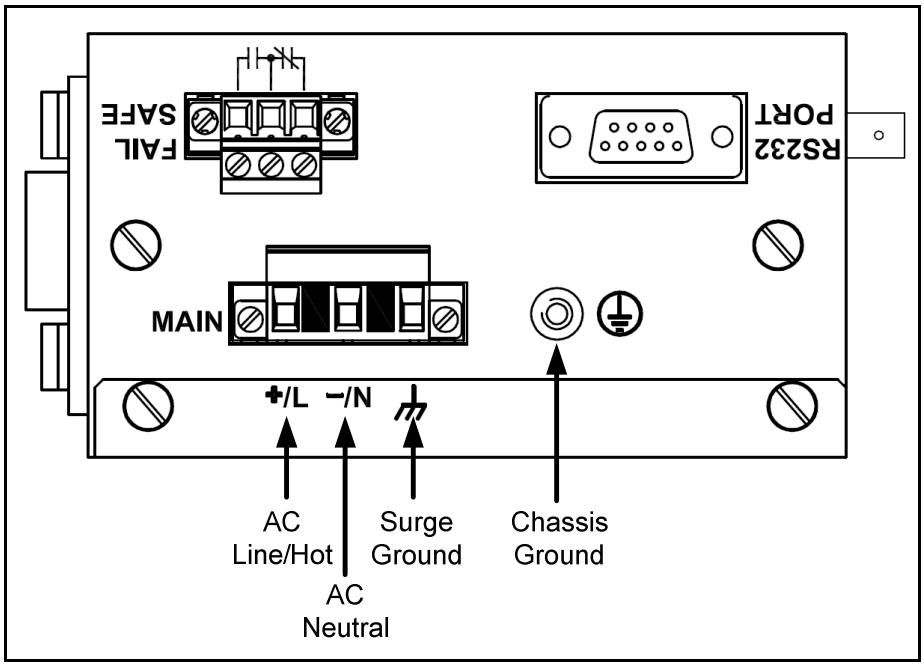

Figure 4 - RS910 Power Supply Inputs

The RS910 AC power supply inputs should be connected as follows:

1. +/L should be connected to AC Line/Hot.
2. -/N should be connected to AC Neutral.
3. Surge Ground should be connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
4. Chassis Ground must be connected to the AC ground terminal.

NOTES:

1. Equipment must be installed according to the applicable country wiring codes.
2. All line-to-ground transient energy is shunted to the Surge Ground terminal. In cases where users require the inputs to be isolated from ground, remove the ground braid between Surge and Chassis Ground. Note that all line-to-ground transient protection circuitry will be disabled.

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2.2.2 DC Power Supply Wiring and Grounding

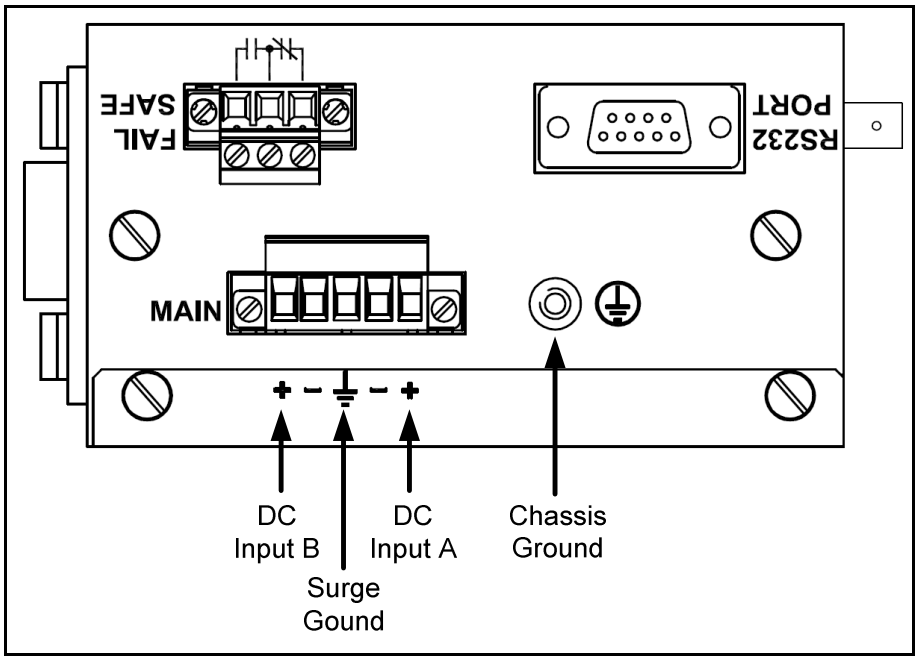

Figure 5 - DC Power supply wiring and grounding diagram

The RS910 low voltage DC power supply features reverse polarity protection and dual independent inputs. The latter feature allows the connection of two DC sources with the same nominal voltage to provide redundant power supply inputs.

The RS910 DC power supply inputs should be connected as follows:

1. Connect to the DC inputs according to the polarity markings on the unit.
2. Surge Ground should be connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the unit.
3. Chassis Ground must be connected to the protective earth.

NOTES:

1. Equipment must be installed according to the applicable country wiring codes.
2. All line-to-ground transient energy is shunted to the Surge Ground terminal. In cases where users require the inputs to be isolated from ground, remove the ground braid between Surge and Chassis Ground. Note that all line-to-ground transient protection circuitry will be disabled.

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2.2.3 Dielectric Strength Testing

Units which are to have dielectric strength testing (HIPOT testing) done in the field must have the braided ground cable disconnected during the test. This is required in order to prevent the surge suppression circuitry, which is connected to surge ground, from being activated.

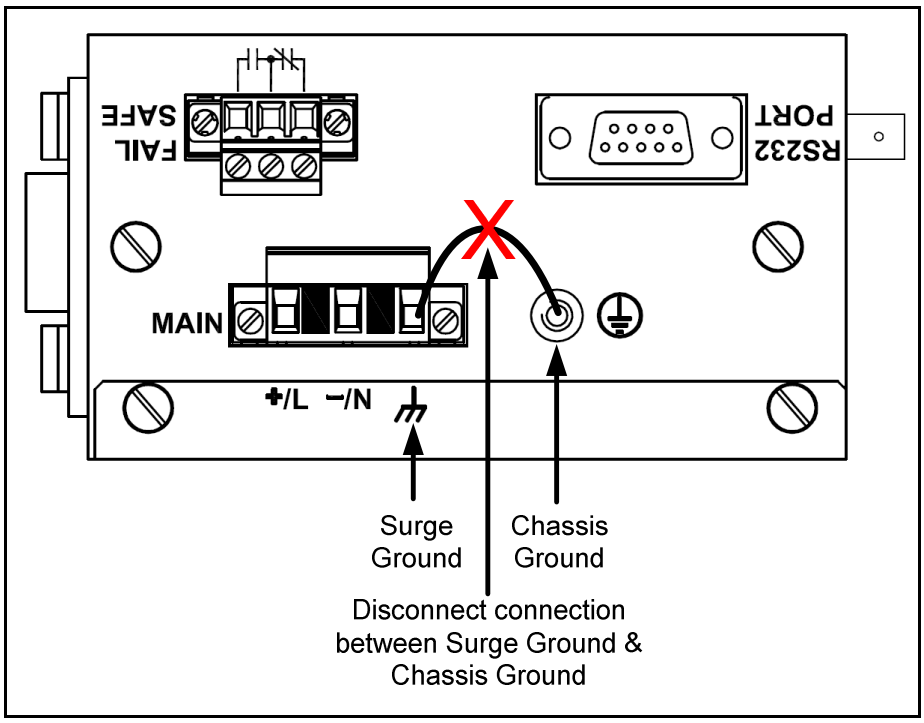

Figure 6 - Dielectric Strength Testing

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2.3 Failsafe Output Wiring

The Failsafe output relay is provided to signal critical error conditions that may occur on the RS910. The contacts are energized upon power up of the unit and remain energized until an alarm condition or power loss occurs. The behavior of the failsafe relay is configurable via the RuggedSwitch Operating System. Consult the RuggedSwitch Users Guide for details.

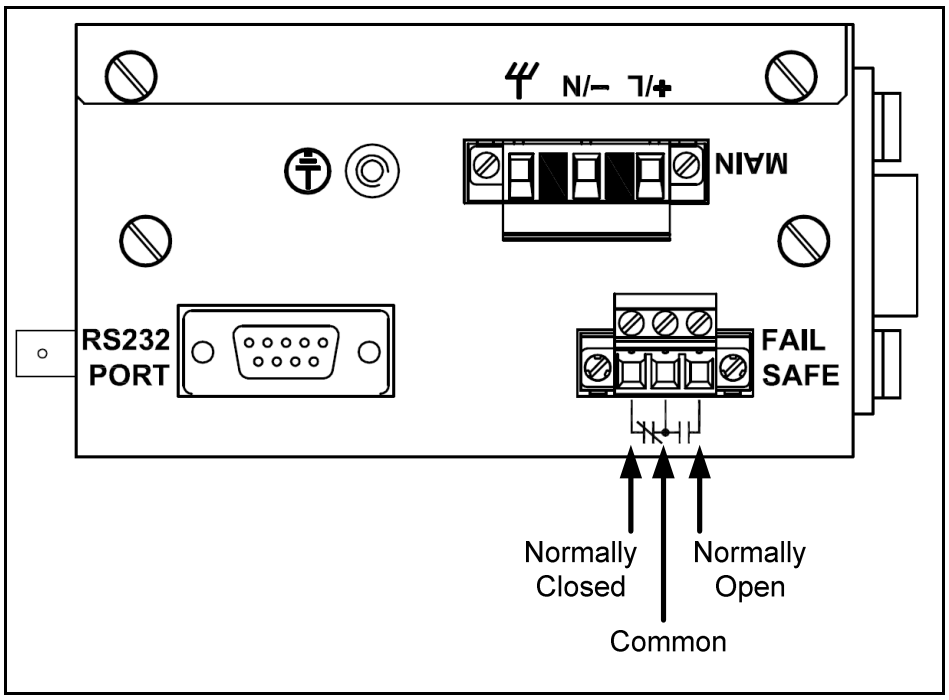

Figure 7 - RS910 Failsafe Output Relay

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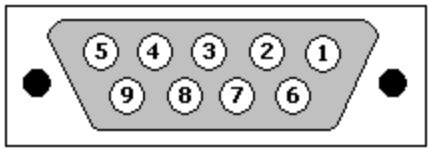
2.4 RS232 Console Port Wiring

The RS232 port is used for configuring the RS910. A straight-through serial cable with a DB-9 connector is required. There is no need to crossover the TxD and RxD signals from the PC side since this has been done internally as is shown in the figure below.



Pin	Signal
1	Internal Connection
2	Transmit Data
3	Receive Data
4	Internal Connection
5	Ground
6	Internal Connection
7	Internal Connection
8	Internal Connection
9	No Connection

Figure 8 - RS232 Female DCE pin-out

NOTE: This port is not intended to be a permanent connection and the cable length should not exceed 2m (6.5 feet). Pins 1,4,6 are connected internally, and pins 7, 8 are connected internally.

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3 Serial Ports

The RS910 can be equipped with a Fiber Serial Interface, RS232/RS485/RS422 DB9 serial ports or RS232/RS485/RS422 RJ45 serial ports.

3.1.1 Fiber Serial Interface

The RS910 can be equipped with a Fiber Serial Interface (ST connector only) which allows RS485, RS422, or RS232 devices to communicate over secure, noise immune, optically isolated, fiber optic cabling at extended distances as well as protocol independent conversion to multimode fiber optics.

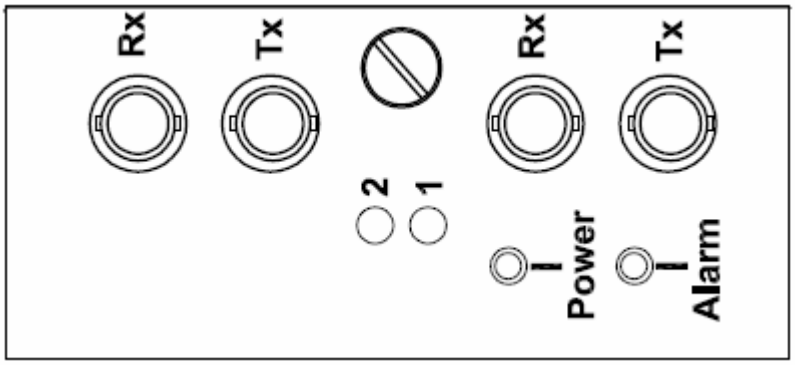

Figure 9: Fiber Serial Interface (ST Connector)

3.1.2 RS232/RS485/RS422 via DB9

Each port is individually selectable via software to be RS232, RS485 or RS422. The DB9 port and pin-out is shown in Figure 10.

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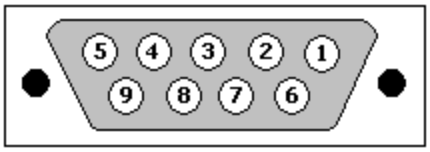

Pin	RS232 Mode	RS485 Mode	RS422 Mode
1	CD	-	-
2	TX	TX/RX+ (A)	TX+
3	RX	-	RX+
4	DTR	-	-
5	Common (Isolated Ground)		
6	DSR	-	RX-
7	CTS	TX/RX - (B)	TX-
8	RTS	-	
9	RI (NC)	-	-
Shield	Chassis Ground		

Figure 10: DB9 Port pin-out

NOTE: Pins 1, 4, and 6 are connected internally. Pins 7 and 8 are connected internally. No internal termination is provided.

3.1.3 RS232/RS485/RS422 via RJ45

Each port is individually selectable via software to be RS232, RS485 or RS422. The RJ45 port and pin-out is shown in Figure 11.

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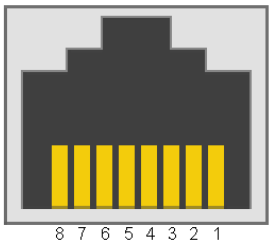

Pin	RS232 Mode	RS485 Mode	RS422 Mode
1	DSR	-	RX-
2	DCD	-	-
3	DTR	-	-
4	Common (Isolated Ground)		
5	RX	-	RX+
6	TX	TX/RX + (A)	TX +
7	CTS	-	-
8	RTS	TX/RX - (B)	TX -
Shield	Chassis Ground		

Figure 11: RJ45 Port pin-out

NOTE: Pins 1, 2, and 3 are connected internally. Pins 7 and 8 are connected internally. No internal termination is provided.

3.1.4 RS485 Wiring

Each RS485 port can communicate to multiple RS485 devices by daisy chaining devices over a single twisted pair with transmit and receive signals on the same two wires (half duplex). The following guidelines should be followed to ensure reliable continuous communication:

1. To minimize the effects of ambient electrical noise, shielded cabling is recommended
2. The correct polarity must be observed throughout a single daisy chain
3. The number of devices wired should not exceed 32, and total distance should be less than 4000 feet (at 100Kbps)
4. The COM terminals should be connected to the common wire inside the shield.
5. The shield should be connected to earth ground at ONE single point to avoid loop currents.
6. The twisted pair should be terminated at each end of the chain.

Figure 12 shows the recommended RS485 wiring.

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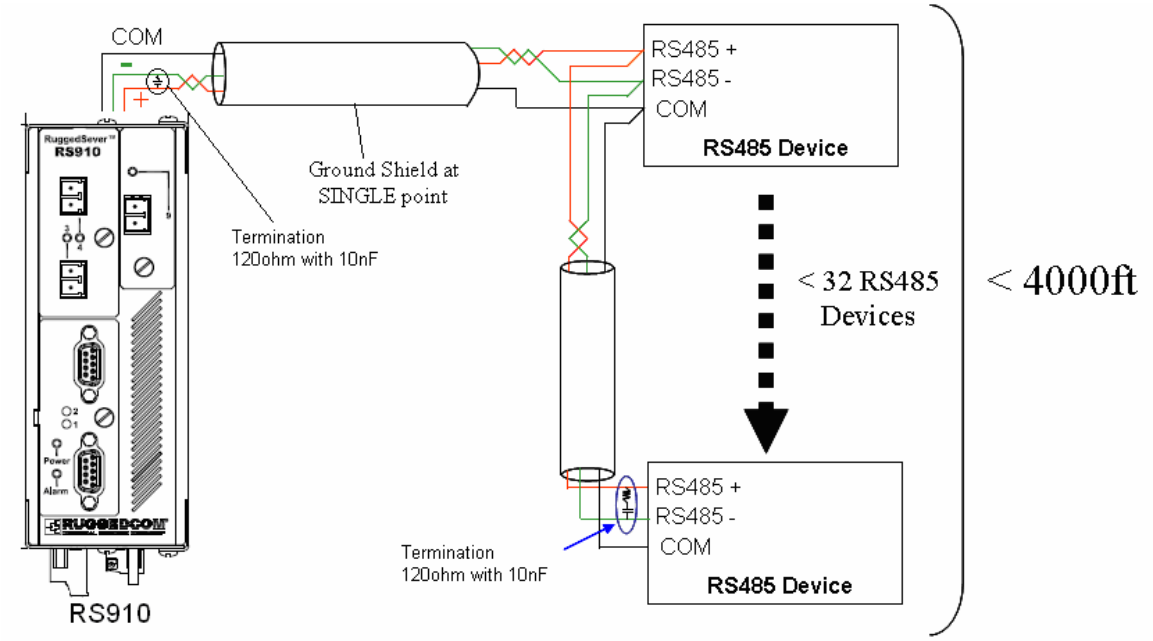

Figure 12: Conceptual recommended RS485 wiring diagram

3.1.5 Serial Port Transient Protection

RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic. RuggedCom also does not recommend to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

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4 Ethernet Ports

4.1 RJ45 Ethernet Ports

The RS910 has several 10/100Base-TX ports that allow connection to standard category 5 (CAT-5) unshielded twisted-pair (UTP) cable with RJ45 male connectors. The RJ45 receptacles are directly connected to the chassis ground on the unit and can accept CAT-5 shielded twisted-pair (STP) cables. If shielded cables are used, care must be taken to ensure the shielded cables do not form a ground loop via the shield wire and the RJ45 receptacles at either end. The figure below shows the RJ45 port pin-out.

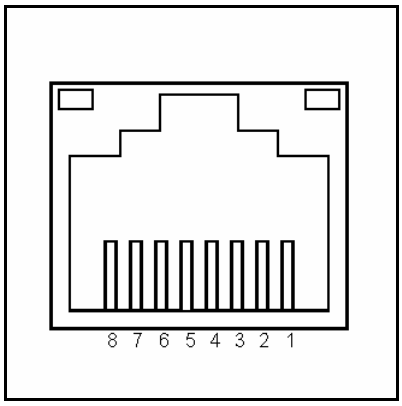

Figure 13 - RJ45 Ethernet port pin-out

Pin	*Signal*
1	+Rx
2	-Rx
3	+Tx
4	No Connection
5	No Connection
6	-Tx
7	No Connection
8	No Connection
Case	Shield (Chassis Ground)

Table 2 – RJ45 Ethernet port pin-out

NOTE: RuggedCom does not recommend the use of CAT-5 (10/100Base-TX communications) cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic.

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RuggedCom also does not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

4.2 Fiber Optic Ethernet Ports

Depending on the order code of the product, the RS910 can be equipped with several different fiber optic ports. The Transmit (Tx) and Receive (Rx) connections of each port must be properly connected and matched for proper link and operation. The drawings in the following figures show each fiber optical connector style with a side and top view to allow the user to identify the proper cable connection orientation.

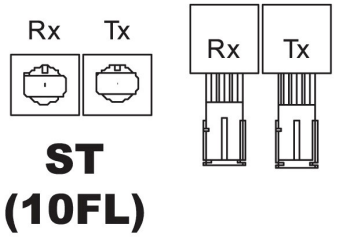

Figure 14: 10FL ST connector

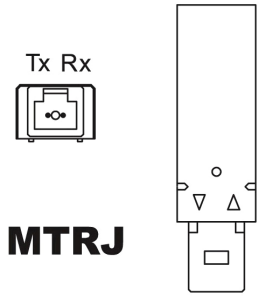

Figure 15: 100FX MTRJ connector

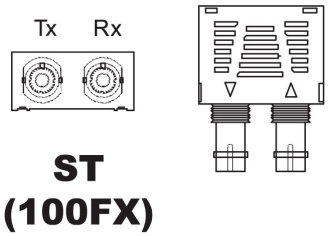

Figure 16: 100FX ST connector

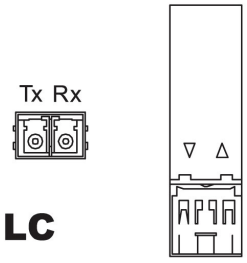

Figure 17: 100FX LC connector

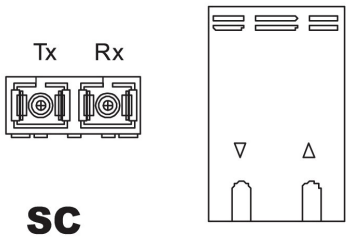

Figure 18: 100FX SC connector

4.3 Ethernet Panel Description

Each Ethernet and Serial port, excluding RJ45 Ethernet on port 9, is equipped with one LED that indicates link/activity status information. The LED will be solid for ports with link, and will blink for activity. The diagram in Figure 19 highlights the port and the associated link/activity LED. RJ45 Ethernet port on port 9 consists of two LEDs and the table below shows the LED description.

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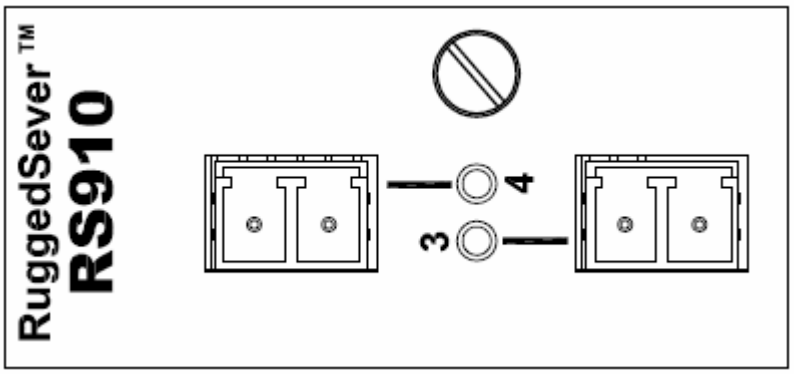

Figure 19: Ethernet panel LED description

Status LED	*Colour*	*Activity*	*Comments*
Speed LED	Yellow	Off	10 Mbps
		On	100 Mbps
Link LED	Yellow	Solid	Link Established
		Blinking	Tx/Rx Activity

Table 3 – RJ45 Ethernet port 9 LED description

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5 Technical Specifications

5.1 Operating Environment

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85°C	Ambient Temperature as measured from a 30 cm radius surrounding the center of the RS910 enclosure.
Ambient Storage Temperature	-40 to 85°C	
Ambient Relative Humidity	5% to 95%	Non-condensing

Table 4 - Operating Environment

5.2 Power Supply Specifications

Power Supply Type	Minimum Input	Maximum Input	Fuse Rating	Isolation	Maximum Power Consumption
12 – 24 VDC	10 VDC	36 VDC	3.15 (T)	1.5 kV DC	10W
24 VDC	18 VDC	36 VDC	3.15 (T)	1.5 kV DC	
48 VDC	36 VDC	72 VDC	3.15 (T)	1.5 kV DC	
HI (125/250 VDC) 1 HI (110/230 VAC) 1	88 VDC 85 VAC	300 VDC 265 VAC	3.15 (T)	4 kV AC 5.5 kV DC	

Table 5 - Power Supply Specifications

NOTES:

1. This is the same power supply for both AC and DC.
2. (F) Denotes fast-acting fuse, (T) denotes time-delay fuse.
3. For continued protection against risk of fire, replace only with same type and rating of fuse.

5.3 Failsafe Relay Specifications

Load Circuit	SELV		TNV-2
MAX operating Voltage	30VDC	30 VAC	80VDC
MAX operating Current	1A	0.5A	0.3A
Isolation (between coil and contacts)	1800 V_{rms}		

Table 6 - Failsafe Relay Specifications

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5.4 Serial Ports

5.4.1 Copper Ports

Parameter	*Specifications*	*Notes*
Baud Rate	300 bps – 230 kbps	
Connector	DB9 or RJ45	
Isolation	2.5 kV	RMS 1-minute

Table 7: Copper Port Specification

5.4.2 Fiber Optic Ports

Parameter	*Specifications*
Mode	Multimode
Connector	ST
Typical Dist. (km)	5
Optical Wavelength (nm)	820
Cable Size Core/Cladding (um)	50/125 62.5/125

Table 8: Fiber Optic Port Specification

NOTES:

1. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.

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5.5 Ethernet Ports

5.5.1 Copper Ports

Parameter	Specification	Notes
Speed	10/100 Mbps	Auto-negotiating
Duplex	FDX / HDX	Auto-negotiating
Cable-Type	> Category 5	Shielded/Unshielded
Wiring Standard	TIA/EIA T568A/B	Auto-Crossover, Auto-polarity
Max Distance	100 m	
Connector	RJ45	
Isolation	1.5 kV	RMS 1-minute

Table 9: Ethernet Ports - Copper Specifications

5.5.2 Fiber Optic Ports

Speed Standard	Mode / Connector	Tx λ (nm)	Cable Type[2] (μm)	Tx Pwr (dBm peak)[3] (Min / Max)	Rx Sensitivity (dBm Average)[3]	Rx Saturation (dBm Peak)[3]	Typical Distance (km)[1]	Power Budget (dB)
100Base-FX	MM / ST	1310	50/125	-15.7	-33.5	-11	2	17
100Base-FX	MM / SC	1310	50/125	-16/-11	-33	-11	2	17
100Base-FX	MM / LC	1310	50/125	-19 / -14	-32	-14	2	15
100Base-FX	MM / MTRJ	1310	50/125	-16/-11	-33.5	-11	2	17
100Base-FX	SM / ST	1310	9/125	-15/-8	-32	-7	20	16.5
100Base-FX	SM / SC	1310	9/125	-13/5	-31	-4	20	20
100Base-FX	SM / LC	1310	9/125	-15/-8	-31	-5	15	16.5

Table 10: Ethernet Ports – Fiber Optic Specifications

NOTES:

1. Maximum segment length is dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.
2. To convert from average to peak add 3 dBm. To convert from peak to average, subtract 3 dBm.

5.6 Communication Standards

Protocol	Standards
Ethernet	IEEE 802.3

Table 11 - Communication Standard Compliance

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5.7 Mechanical Specifications

Parameter	Value
Dimensions	16.8 x 11.7 x 6.6 cm / 6.6 x 4.6 x 2.6 inches
Weight	1.2 kg / 2.7 lbs
Enclosure	20 AWG Galvanized Steel

Table 12 - Mechanical Specifications

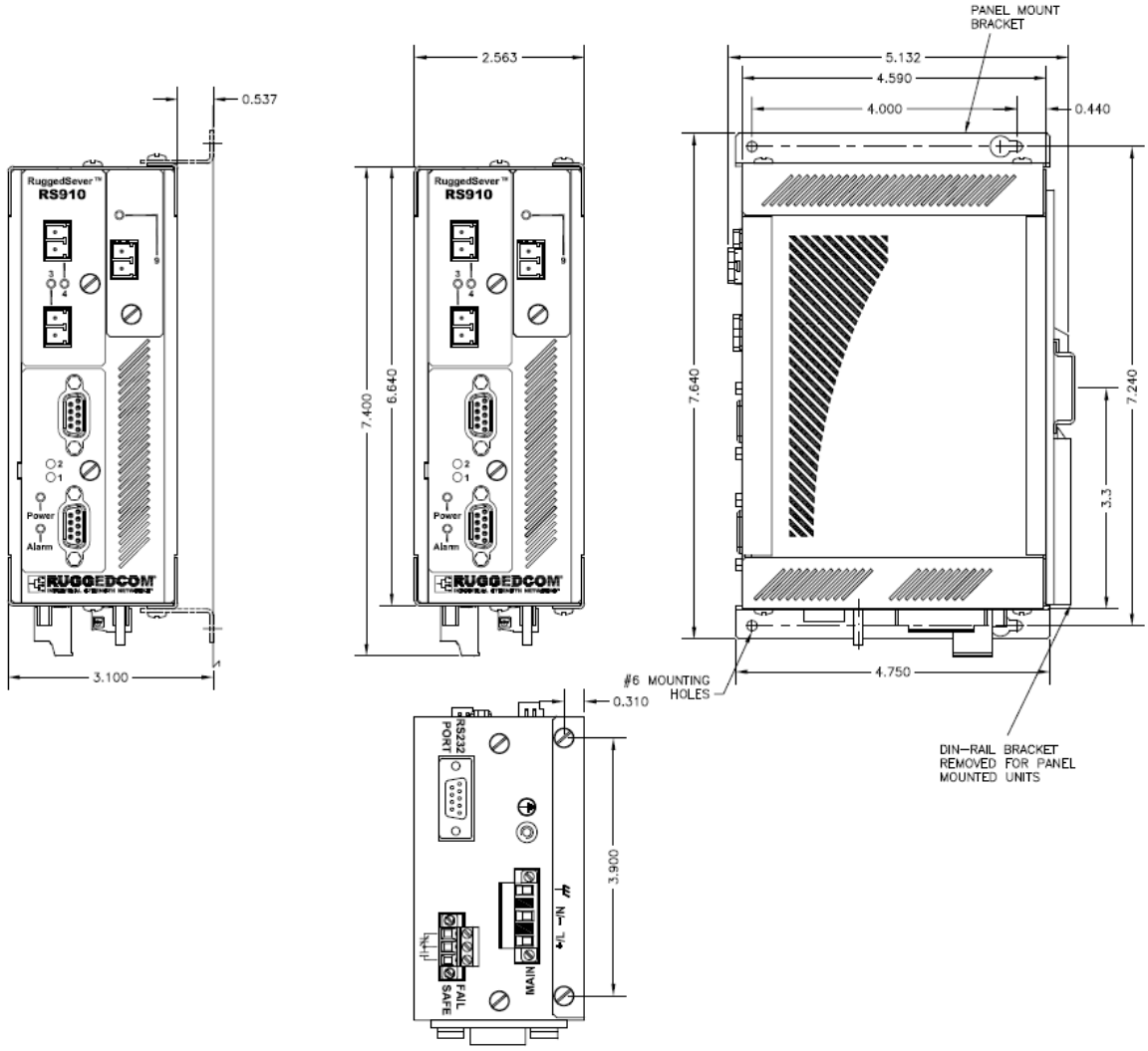

Figure 20 - Mechanical Specifications

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6 Type Tests

6.1 IEC 61850-3 Type Tests

Test	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8kV	4
		Enclosure Air	+/- 15kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	x
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4kV @ 2.5kHz	x
		D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports	+/- 4kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V	3
		D.C Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports	10V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
		A.C. Power ports	30% for 1 period, 60% for 50 periods	N/A
IEC 61000-4-11			100% for 5 periods, 100% for 50 periods[2]	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV differential mode @ 1MHz	3
		D.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
		A.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continuous, 300V for 1s	4
		D.C. Power ports	30V Continuous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2kVac (Fail-Safe Relay output)	N/A
		D.C. Power ports	2kVac	N/A
		A.C. Power ports	2kVac	N/A
IEC 60255-5	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A

Table 13 - IEC 61850-3 Type Tests

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6.2 IEEE 1613 Type Tests

Test	Description		Test Levels
IEEE C37.90.3	ESD	Enclosure Contact	+/- 8kV
		Enclosure Air	+/- 15kV
IEEE C37.90.2	Radiated RFI	Enclosure ports	35 V/m
IEEE C37.90.1	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz
		D.C. Power ports	+/- 4kV
		A.C. Power ports	+/- 4kV
		Earth ground ports	+/- 4kV
IEEE C37.90.1	Oscillatory	Signal ports	2.5kV common mode @ 1MHz
		D.C. Power ports	2.5kV common & differential mode @ 1MHz
		A.C. Power ports	2.5kV common & differential mode @ 1MHz
IEEE C37.90	H.V. Impulse	Signal ports	5 kV (Failsafe Relay)
		D.C. Power ports	5 kV
		A.C. Power ports	5 kV
IEEE C37.90	Dielectric Strength	Signal ports	2kVac (Failsafe Relay)
		D.C. Power ports	2kVac
		A.C. Power ports	2kVac

Table 14 - IEEE 1613 Type Tests

NOTE:

- If the unit contains copper ports the IEEE 1613 conformance is Class 1 (During disturbance errors may occur but recovery is automatic).
- If the unit contains all fiber ports the IEEE 1613 conformance is Class 2 (During disturbance no errors will occur).

6.3 IEC Environmental Type Tests

Test	Description		Test Levels	Severity Levels
IEC 60068-2-1	Cold Temperature	Test Ad	-40 deg. C, 16 Hours	N/A
IEC 60068-2-2	Dry Heat	Test Bd	+85 deg. C, 16 Hours	N/A
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55 deg C, 6 cycles	N/A
IEC 60255-21-1	Vibration	Tests Fc	2g @ (10-150) Hz	Class 2
IEC 60255-21-2	Shock	Tests Ea	30g @ 11ms	Class 2

Table 15 - Environmental Type Tests

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7 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit http://www.ruggedcom.com or contact your customer service representative. Should this product require warranty or service contact the factory at:

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Woodbridge, Ontario
Canada L4L 7Z4

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